

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. An image processing system having a statistical appearance model for interpreting a
5 digital image, the appearance model having at least one model parameter, the system
comprising:
 - a multi-dimensional first model object including an associated first statistical
relationship and configured for deforming to approximate a shape and texture of a multi-
dimensional target object in the digital image, and a multi-dimensional second model object
10 including an associated second statistical relationship and configured for deforming to
approximate the shape and texture of the target object in the digital image, the second model
object having a shape and texture configuration different from the first model object;
 - a search module for applying the first model object to the image for generating a
multi-dimensional first output object approximating the shape and texture of the target object
15 and calculating a first error between the first output object and the target object, and for
applying the second model object to the image for generating a multi-dimensional second
output object approximating the shape and texture of the target object and calculating a
second error between the second output object and the target object;
 - a selection module for comparing the first error with the second error such that one of
20 the output objects with the least significant error is selected; and
 - an output module for providing data representing the selected output object to an
output.
2. The system according to claim 1; wherein the first model object is optimised for
25 identifying a first one of the target object and the second model object is optimised for
identifying a second one of the target object, such that the second target object having an
shape and texture configuration different from the first target object.
3. The system according to claim 2 further comprising the digital image being one of a
30 set of digital images, wherein each of the model objects are configured for being applied by
the search module to each of the digital images of the set.

4. The system according to claim 3 further comprising the selection module configured for selecting one of the object models to represent all the images in the set.
- 5 5. The system according to claim 1; wherein the output is selected from the group comprising an output file for storage in a memory and a user interface.
6. The system according to claim 2 further comprising a training module configured for having a set of training images including a plurality of training objects with different appearance configurations, the training module for training the appearance model to have a
10 plurality of the model objects optimised for identifying valid ranges of the shape and texture of respective ones of the target object.
7. The system according to claim 2, wherein the appearance model is an active
15 appearance model.
8. The system according to claim 2, wherein the first and second model objects represent different pathology types of patient anatomy.
- 20 9. The system according to claim 2, wherein the first and second model objects represent different appearance configurations of the same anatomy of two different two dimensional slices taken from spaced apart locations of an image volume of the anatomy.
10. The system according to claim 8, wherein the two different pathology types
25 represented by two different training objects in a set of training images.
11. The system according to claim 1 further comprising a predefined characteristic associated with the model parameter of the selected model object, the predefined characteristic for aiding a diagnosis of a patient having an anatomy represented by the
30 selected output object.

12. The system according to claim 11, wherein the model parameter is partitioned in to a plurality of value regions, each of the regions assigned one of a plurality of the predefined characteristics.
- 5 13. The system according to claim 12, wherein the model parameter is selected from the group comprising a shape and texture parameter, a scale parameter and a rotation parameter.
14. The system according to claim 12, wherein at least two of the predefined characteristics represent different pathology types of the anatomy.
- 10 15. The system according to claim 12, wherein the output module provides to the output the predefined characteristic assigned to the selected output object.
16. The system according to claim 12 further comprising a training module configured for
15 assigning the plurality of the predefined characteristics to the model parameter.
17. The system according to claim 15 further comprising a confirmation module for determining if the value of the model parameter assigned to the selected output object is within one of the partitioned regions.
- 20 18. The system according to claim 17, wherein the value of the model parameter when outside of all the partitioned value regions indicates the first output object is an invalid approximation of the target object.
- 25 19. An image processing system having a statistical appearance model for interpreting a sequence of digital images, the appearance model having at least one model parameter, the system comprising:
- a multi-dimensional model object including an associated statistical relationship, the model object configured for deforming to approximate a shape and texture of multi-
30 dimensional target objects in the digital images;
- a search module for selecting and applying the model object to the images for

generating a corresponding sequence of multi-dimensional output objects approximating the shape and texture of the target objects, the search module calculating an error between each of the output objects and the target objects;

an interpolation module for recognising at least one invalid output object in the
5 sequence of output objects, based on an expected predefined variation between adjacent ones of the output objects of the sequence, the invalid output object having an original model parameter; and

an output module for providing data representing the sequence of output objects to an output.

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20. The system according to claim 19 further comprising an interpolation algorithm of the interpolation module for calculating an interpolated model parameter from a pair of adjacently bounding output objects of the sequence, the pair located on either side of the invalid output object, the interpolated model parameter for replacing the original model
15 parameter.

21. The system according to claim 20, wherein the interpolated model parameter is selected from the group comprising position, scale, rotation, and shape and texture.

20 22. The system according to claim 20, wherein determination of the invalid output object is based on the original model parameter being outside of a predefined parameter threshold.

22. The system according to claim 20, wherein determination of the invalid output object is based on the first error being outside of a predefined error threshold.

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23. The system according to claim 20, wherein there is a plurality of adjacent invalid output objects.

24. The system according to claim 20, wherein the interpolation of the interpolation
30 algorithm is based on a predefined interpolation relationship based on a magnitude of separation between the pair of bounding output objects and the invalid ourput object in the

sequence.

25. The system according to claim 20, wherein the search module reapplies the first model object to the images using the interpolated model parameter as input in order to generate a
5 new output object to replace the invalid output object in the sequence.

26. The system according to claim 19, wherein the sequence is selected from the group comprising temporal and spatial.

10 27. A method for interpreting a digital image with a statistical appearance model, the appearance model having at least one model parameter, the method comprising the steps of:
providing a multi-dimensional first model object including an associated first statistical relationship and configured for deforming to approximate a shape and texture of a multi-dimensional target object in the digital image;
15 providing a multi-dimensional second model object including an associated second statistical relationship and configured for deforming to approximate the shape and texture of the target object in the digital image, the second model object having a shape and texture configuration different from the first model object;
applying the first model object to the image for generating a multi-dimensional first
20 output object approximating the shape and texture of the target object;
calculating a first error between the first output object and the target object;
applying the second model object to the image for generating a multi-dimensional second output object approximating the shape and texture of the target object;
calculating a second error between the second output object and the target object;
25 comparing the first error with the second error such that one of the output objects with the least significant error is selected; and
providing data representing the selected output object to an output.

28. A computer program product for interpreting a digital image using a statistical
30 appearance model, the appearance model having at least one model parameter, the computer program product comprising:

a computer readable medium;

an object module stored on the computer readable medium configured for having a multi-dimensional first model object including an associated first statistical relationship and configured for deforming to approximate a shape and texture of a multi-dimensional target object in the digital image, and a multi-dimensional second model object including an associated second statistical relationship and configured for deforming to approximate the shape and texture of the target object in the digital image;

a search module stored on the computer readable medium for applying the first model object to the image for generating a multi-dimensional first output object approximating the shape and texture of the target object and calculating a first error between the first output object and the target object, and for applying the second model object to the image for generating a multi-dimensional second output object approximating the shape and texture of the target object and calculating a second error between the second output object and the target object, the second model object having a shape and texture configuration different from the first model object;

a selection module coupled to the search module for comparing the first error with the second error such that one of the output objects with the least significant error is selected; and

an output module coupled to the selection module for providing data representing the selected output object to an output.

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29. A method for interpreting a digital image with a statistical appearance model, the appearance model having at least one model parameter, the method comprising the steps of:

providing a multi-dimensional model object including an associated statistical relationship, the model object configured for deforming to approximate a shape and texture of multi-dimensional target objects in the digital images;

applying the model object to the images for generating a corresponding sequence of multi-dimensional output objects approximating the shape and texture of the target objects;

calculating an error between each of the output objects and the target objects; and

recognising at least one invalid output object in the sequence of output objects, based on an expected predefined variation between adjacent ones of the output objects of the sequence, the invalid output object having an original model parameter; and

providing data representing the sequence of output objects to an output.